The content of this note is based on information received from manufacturers in the electrical and electronics industries or their representatives and does not imply practical experience by Elektor Electronics or its consultants.

EL lamp driver Type IMP803

high voltage on chip

EL (electroluminescent) lamps are used primarily for the background lighting required by liquid-crystal display panels used in much battery operated equipment where low current drain is a prime requirement. The IMP803 driver for such lamps contains the requisite basic circuits: a switch-mode power supply using a high-frequency oscillator and a high-voltage H-bridge output driver using a low-frequency oscillator. It can drive lamps of up to 30 nF ($10\ in^2$) to high brightness.

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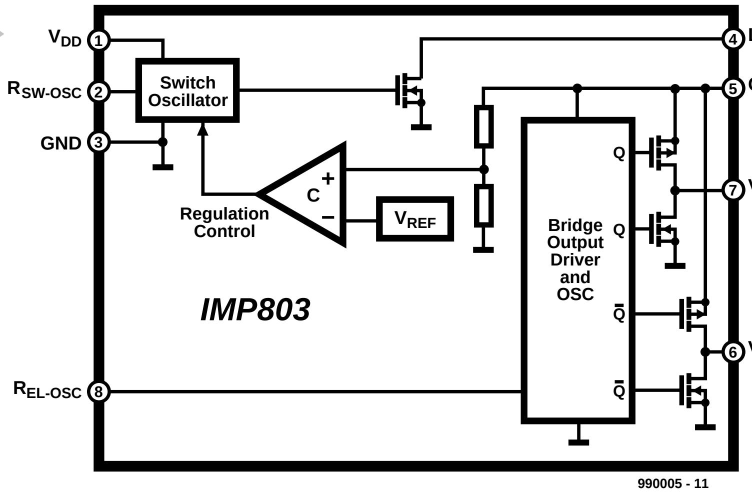

Figure 1. Circuit diagram of the IMP803 EL lamp driver.

Main parameters

- ➜ *Low power: 420 µA typical input current*
- ➜ *Wide operating voltage range: 2.0–6.0 V*
- ➜ *180 V peak-to-peak typical a.c. output voltage*
- ➜ *Large output load capability: drives lamps with up to 30 nF capacitance to full brightness*
- ➜ *Adjustable output lamp frequency for control of lamp colour, lamp life, and power consumption*
- ➜ *Adjustable converter frequency to minimize power consumption*
- ➜ *Device can be enabled/disabled*
- ➜ *Low quiescent current: 20 nA (disabled)*
- ➜ *High-voltage CMOS process*

An IMP, Inc. Application

INTRODUCTION

Although the IMP803 is intended for driving EL lamps of up to 30 nF capacitance to high brightness, it can drive lamps with greater capacitance, but not to full light output.

The typical regulated output voltage that is applied to the EL lamp is 180 V_{p-p} The device requires few external components as shown in **Figure 2**: a single inductor, a single catch diode, two capacitors, and three resistors. Two of these resistors set the frequency for two internal oscillators.

The IMP803 operates over supply voltage range of 2.0–6.0 V. A regulated, low-power source can supply the low quiescent current of the device. The inductor may be driven from a higher supply voltage in dual supply applications.

An internal circuit shuts down the switching regulator when the lamp drive voltage reaches 180 V p-p. This conserves power and extends battery life.

The IMP803 can also be operated from a single battery when a regulated voltage higher than 2.0 V is available.

The dual supply configuration shown in Figure 2 uses the regulated voltage to operate the IMP803 while the energy for the high-voltage boost comes from the battery. The current to run the internal logic is typically 420 µA. The circuit in Figure 2 can also be used with batteries that exceed 6.5 V as long as V_{DD} does not exceed 6.0 V.

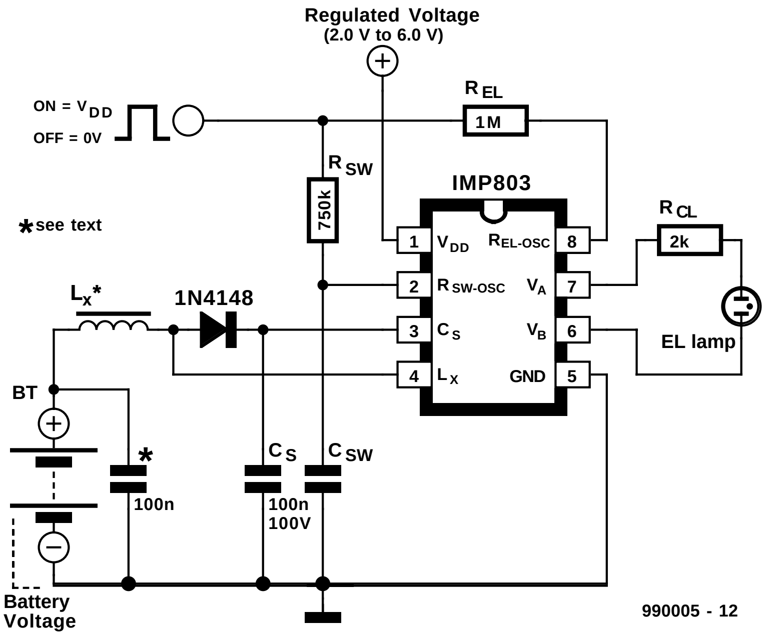

Figure 2. Standard circuit for dual supply operation of the IMP803 with high battery voltages.

EXTERNAL COMPONENTS

The function of the external components shown in Figure 2 are described below.

The catch diode is a fast reverse recovery type with a reverse bias voltage greater than 100 V. A Type 1N4148 meets these requirements.

Capacitor C_S is a high-voltage type that stores the inductive energy transferred through the catch diode. Its recommended value is 0.01–0.1 µF at a voltage rating of 100 V.

Capacitor C_{SW} is a noise-suppression component connected between ground and the $R_{SW\text{-}OSC}$ pin. It has a recommended value of 0.001 µF

Resistor R_{EL} is the frequency setting component for the EL lamp oscillator. Connected between the $R_{EL\text{-}OSC}$ pin and V_{DD}, it provides an oscillator frequency that is inversely proportional to its value, that is, when R_{EL} increases, the EL lamp frequency decreases along with the current drawn by the lamp. Lamp colour is also determined by this frequency. A resistance value of 2 MΩ results in a lamp frequency of about 350 Hz; a value of 1 MΩ gives a frequency of around 700 Hz. When the resistor, together with R_{SW}, is linked to ground instead of to V_{DD}, the IC is disabled.

Resistor R_{SW}, connected between the $R_{SW\text{-}OSC}$ pin and V_{DD}, sets the frequency of the switch-mode oscillator. The switching frequency is inversely proportional to the resistance value, dropping as the resistance increases.

Inductor L_X provides the requisite voltage by inductive flyback. The internal MOSFET switch alternately opens and closes the ground connection for the inductor at the L_X pin. When this internal switch opens, the inductor potential will forward-bias the catch diode and the current will pass through the storage capacitor, C_S, charging it to a high voltage. The recommended type of inductor is a Murata LQH4N561K04, which has a d.c. resistance of 14.5 Ω and an inductance of about 500 µH.

Lower value inductors are preferred to prevent saturation. As the value of the inductor rises (and the series d.c. resistance of the inductor decreases), the switching frequency set by R_{SW} should be increased to prevent saturation. In general, lower value inductors that can handle more current are desirable when larger area EL lamps are to be driven.

The size of the lamp is important to the operation of the IMP803. Larger lamps will draw more current requiring more power dissipation in the IMP803. An external resistor in series with the lamp, R_{CL}, will protect the output drivers from high transient currents during lamp commutation.

The capacitor across the battery has a preferred value of 0.1 µF. It serves to compensate for the impedance of the battery. Its value may have to be increased depending on the impedance of the battery.

The IMP803 may be enabled and disabled by a CMOS gate connected between V_{DD} and the junction of R_{EL} and R_{SW}. The device is enabled when R_{SW} is linked to V_{DD} and disabled when R_{SW} is connected to V_{DD}. Resistor R_{EL} may be connected to V_{DD} or to the output of the gate.

[990005]

Source: Data sheet ‘IMP803 high-voltage EL lamp driver’ (IMP, Inc.) (www.impweb.com)

Applications

➜ GPS units; pagers, cellular phones
➜ Handheld computers
➜ Safety illumination
➜ Portable instrumentation
➜ Battery-operated displays
➜ Liquid-crystal display (LCD) panels

Pin descriptions

Nr.	Name	Function
1	V_{DD}	Positive voltage supply for the IMP803. Inductor L may be connected here or to a separate unregulated supply.
2	$R_{SW\text{-}OSC}$	Switch-mode resistor pin. Switching frequency is determined by an external resistor, R_{SW}.
3	C_S	Boost converter storage capacitor. The voltage across the EL lamp is equal to twice the voltage at C_S.
4	L_X	Connection to flyback inductance L.
5	GND	Ground pin.
6	V_B	EL lamp drive. The lamp is connected in a high-voltage bridge circuit with V_B providing the complementary connection to V_A. The peak-to-peak a.c. voltage across the EL lamp is thus two times V_{CS}
7	V_A	EL lamp drive (see above).
8	$R_{EL\text{-}OSC}$	The EL lamp oscillator frequency setting pin. The oscillator frequency is controlled by external resistor R_{EL}.